OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON 25, D. C.

[redacted]

DEC 1 1958

MEMORANDUM REPORT FOR DIRECTOR, DEPUTY DIRECTOR, AND CHIEF SCIENTIST, ARPA

SUBJECT: Reorientation of 117L Program

[redacted]

The [redacted] Reconnaissance System is designed to fulfill requirements vital to the defense of the United States. Operational weapons systems, utilizing heavy satellites, are required in calendar year 1960 to meet the estimated period of maximum Soviet military threat to this country.

The threat in this time period requires maintaining a retaliatory capability in the event of a Soviet attack. Maximum warning time, improved military communications to key strategic bases and units in flight, and the ability for the U.S. to penetrate the enemy radar defenses are essential in order to maintain a truly military deterrent force and to prevent our SAC fleet from being destroyed on the ground. Further, the importance of knowing [illegible] the current and changing Soviet military posture in terms of numbers of missiles, missile sites, new military weapons, force deployment, and detection of new and hitherto unknown targets and verification of known targets is enormous in terms of maintaining the proper U.S. defensive and offensive military posture, and could be the key to future national survival in the event of a Soviet attack.

Weapons systems, utilizing satellites for early warning, communications, [redacted], visual reconnaissance, and mapping, are the only presently known way of obtaining the information required in this time period. For example, National Intelligence Estimates indicate that by late 1960 to mid-1961, the Soviets will have installed on site, ready to fire, on the order of 300 ICBM's; further, in the period 1961-1962, on the order of 500 ICBM's would be ready to go. It is obvious that prior to physically installing such a fleet of missiles considerable site preparations are required during 1959 and 1960, new site locations are involved, and new strike force deployment. Knowledge in advance of this buildup and the site locations in terms of

map coordinate positions is vital. Waiting too long to obtain this information would result in these sites so camouflaged that it would be difficult, if not impossible, to obtain this information with visual photography. Herein lies the key to the urgency of getting the many types of information mentioned as soon as possible. Timeliness of receipt of this type of intelligence information is essential.

The WS-117L Program is designed to meet these information-gathering objectives. The funding in FY 1960 has been reduced from an estimated requirement of $297 million to $160 million to meet the budget ceiling that has been directed by the Deputy Secretary of Defense. To maintain the program's balance and ability to achieve the objectives indicated, considerable redirection is required, involving both numbers of vehicles, technical approach, and elimination from the R&D budget of all vehicles that can be considered operational in order to have a program fit the FY 1960 $160 million budget ceiling.

A revised marginal program is discussed herein that meets the technical information requirements and stays within the budget ceiling described above.

RECOMMENDED PROGRAM

THOR FIRES: It is proposed that the entire Thor Program presently funded in FY 1960 be canceled. This would reduce the total Thor Program from 19 to 15 launchings and would eliminate the cost of an additional operating crew. We would transfer 2 of the remaining 15 vehicles to other ARPA programs, leaving 13 Thors in the schedule to be funded in FY 1959 and fired at the maximum rate possible from a single launcher. Of these 13 Thor flights, the first two are vehicle development flights; the next two are vehicle development flights with recovery being exercised and containing mice. Eight vehicles would contain the "C" package and one vehicle is to carry a small primate for bio-medical purposes. This program revision would include deferring any amount of SEK, not yet expended for a second launcher, to meet the needs of a follow-on program. The FY 1960 costs for the Thor Program amount to $30 million and this amount would be saved.

Table I presents the revised Thor Firing Program as compared to the original program. It is important to realize that ARPA's program responsibility ends when a system has been brought through its Research and Development. At this point it is available for

users. Obviously, however, the users should be informed as to the R&D program and become familiar with its scheduled termination so that plans can be made concurrently if the operational capability is urgently required to arrange for their own vehicle needs and firing schedule requirements. In any case, program responsibility beyond the R&D phase, including budget justifications, are not the responsibility of ARPA.

Some other agency may wish to risk the purchase of additional vehicles for a parallel program on the other launcher prior to obtaining any data out of the R&D program. If such a parallel program is desired, the vehicle orders must be placed now by the other agency.

Budget changes associated with the Thor Program for FY 1959 and FY 1960 are discussed in detail in a later section of the report entitled "Revised Program Budget Item Changes - FY 1959-1960."

[redacted] ATLAS PROGRAM

The Thor Program, as presently conceived, is very marginal from a weight standpoint. Short life, low orbit, high recovery cost, and only a visual data capability is available with the Thor vehicle. This leads to a low confidence level in obtaining a successful shot and to high cost per bit of information obtained. The recovery operation associated with the Thor is extremely costly because of having to cover a tremendous area with aircraft and ships.

The type of data obtained, if successful, is very attractive. The 15-20 foot resolution associated with the 24-inch camera is much more valuable in the time period in question than the 100 foot resolution data obtainable from a 6-inch camera. Our reasoning in this respect is as follows:

In the event of a Soviet attack in the time period from present to 1963 or later, the sequence of important items of information develops in the following manner:

(1) Global early warning information at the launch of an enemy attack permits our deterrent forces to be alerted; and in the case of SAC (our prime deterrent force) aircraft are in the air and on their way to enemy targets. This minimizes the possibility of SAC being destroyed on the ground by a surprise Soviet attack. Once our deterrent force is unleashed to strike, it must

know where to strike and what the vital targets are: therefore;

(2) Visual reconnaissance data to ground resolutions on the order of 15-20 feet or better is extremely valuable in being able to identify new and old targets, new military vehicles, missile deployment, enemy strike force capability, etc. This type information permits the U.S. to know what the immediate military threat is and also indicates the longer range Soviet military posture by indicating new type military vehicles and their potential deployment. An associated part of this type information is the ability to have mapping information so that the map coordinate positions of targets, new and old, can be obtained. This permits the U.S. to accurately direct its strike force, be it manned bombers or missiles, to the proper locations to kill their targets. An additional portion of critical information is needed. This directly relates to the U.S.'s ability with manned bombing systems to penetrate enemy territory once committed to deliver its weapons: therefore;

(3) ELINT or PINNEY data is extremely important to establish the Soviet's radar order of battle. The Soviet's have demonstrated a remarkable capability in their ground radar performance. Furthermore, there is evidence that new advanced type of ground base radar systems are being installed within the USSR. In order for our SAC fleet to successfully penetrate the Soviet's defenses, we must know what the characteristics of these new and old radars are and where they are. Having this information, permits the U.S. to design effective electronic countermeasure (ECM) equipment to jam these Soviet installations. The ability to jam effectively or not jam effectively can determine to a major extent the effectiveness of our SAC fleet to deliver its weapons. Finally, the ability to successfully communicate during enemy attack so that military commanders can deploy and direct the U.S. military deterrent force is another immediate area of concern: therefore;

(4) Communications on a global basis with a secure (non-jammable) system is required.

The revised program for WS-117L suggested herein is cognizant of the military needs specified in items (2) and (3) above. Items

(1) and (4) are being covered by other ARPA programs although item (1) was originally contained in WS-117L. The vehicle program recommended herein, will provide a system for all-purpose application and can, to a certain degree, serve the immediate needs of early prototype hardware developed to meet the needs indicated in items (1) and (4).

Thus, in order to meet the stated military requirements, we would proceed with the development of a modified Atlas/Sentry vehicle, employing a long-life 24-inch camera payload, a recoverable capability, a ferret payload (can be readout or recoverable), and a mapping payload. The payloads mentioned could also be used singularly or in combination. The longer range R&D phase of the Atlas Program would include the 36-inch camera, an all electronic readout and storage (eliminating the film and chemical processing), and advanced ferret hardware. The need for any further development of the 6-inch camera is eliminated.

VEHICLE: The modified Atlas/Sentry vehicle, by providing greater payload-in-orbit capability, would provide for a substantial increase in film storage capacity, better stabilization features, and the development of a much improved retro-rocket system possessing greater thrust capability in the Sentry-stage engine sufficient to effect substantial reduction in recovery area requirements on either land or sea.

The vehicle development program should be aimed at providing the following specific features which would then make it an "all-purpose" vehicle with a wide range of application and utility for a variety of military space payloads.

1. The vehicle first stage should be the Atlas.

2. The vehicle second stage should incorporate a modified Bell-Rustler engine which uses [redacted] and has dual-burn capability.

3. The stabilized playform in space should incorporate a guidance system which maintains a stable platform over a wide range of payload weight distribution and payload changes up to the maximum allowable weight in orbit as limited by the boosting system. This will permit a wide selection of different type payloads for later use in the vehicle without changing the guidance system each time.

4. The retro-rocket system should be designed to reduce to a minimum re-entry dispersion errors. The retro-rocket system should be capable of inducing a re-entry for a low "g" trajectory (8-12 g's) and/or a high "g" re-entry trajectory (35-45 g's).

5. The re-entry heat shield attachments should be designed to provide for both high and low re-entry conditions with the optimum of attaching the proper heat shield for the particular flight desired. In other words, if it is decided that, for certain tests using this vehicle, re-entry is to be held to low "g" (low angle) level, then the appropriate heat shield can be attached to the payload structure before launch. If high "g" is desired, then a different heat shield would be attached.

6. The vehicle should be provided with a transponder that is useable with the AZUSA ground base tracking system in order to establish a highly accurate orbit prediction capability which this ground based system has already demonstrated.

Further, the same vehicle combination would be utilized for advanced R&D toward developing a complete all-electronic data readout system to replace the presently proposed combined film processing in the orbiting vehicle and electronic readout-to-ground capability. The latter offers no real advancement in technique over the recoverable package method, which is virtually available now, because it has a limited time-in-orbit capability dependent upon the short life of the film-processing material.

[redacted] - FY 1959-60

Budget reorientation required to accomplish the above program changes within the established ceilings is approximately as follows:

(Cost data used in this analysis is taken from DOD Report [redacted])

FY 1959

	15 Sept. Rev. Plan	Proposed Program
THOR Program	138.8	112.1
Facilities	28.8	14.7
Atlas Program	73.6	88.2
Total	231.2	215.0

The following assumptions were made in arriving at the above figures:

THOR Program

(1) Costs presented for FY 59 covered costs in that year for 15 vehicles and that costs to be transferred to other ARPA programs would be prorated on that basis.

(2) Estimated support costs to the amount of $6.4 million would not be charged to the Juntcy Program.

(3) The Geophysical research program at CEC would be cancelled immediately for an estimated savings of $.2 million.

(4) A reduction of launch crews from two to one would reduce the engineering costs by $.5 million.

COST SUMMARY THOR PROGRAM

Item	15 Sept. Rev Plan	Reductions	Transfer	Proposed Plan
Program Management	3.1		.4	2.7
Systems Engineering, etc.	22.8	.5	2.8	19.5
SS A (airframe)	8.0		1.0	7.0
SS B (propulsion)	14.6		2.1	12.5
SS C (auxiliary power)	2.6		.3	2.3
SS D (guidance & control)	2.5		.3	2.2
SS E (ground-space communications)	30.0			30.0

Item	15 Sept. Rev Plan	Reductions	Transfer	Proposed Plan
SS L (recovery capsule)	7.9			7.9
GSE (ground systems equipment)	7.0			7.0
CRC (Cambridge Research Center)	1.2	.2		1.0
Boosters	15.2		2.4	12.8
STL (Space Technology Laboratory)	.6			.6
Support	12.5	6.4		6.1
Miscellaneous	.8		.1	.7
	125.8	7.1	9.4	112.1

Facilities Programs

(1) All construction at operational sites located NE, NW, and Central will be eliminated (10.1 million)

(2) Construction of miscellaneous development and data handling centers will be eliminated. (2.78 million)

(3) Costs of construction planning will be absorbed by the USAF. (1.2 million)

COST SHARING FACILITIES

Item	15 Sept. Rev Plan	Proposed Program
Operational Sites	10.10	
Miscellaneous Sites	2.78	
Construction Planning	1.20	
Launcher Cooke AFB	6.30	6.30
Assembly Building	3.00	3.00
Industrial Facilities	5.40	5.4
	28.78	14.70

Atlas Programs

(1) All remaining funds be applied to reoriented Atlas Program.

(2) Program management and systems engineering costs be increased in proportion to above.

(3) SS A be reoriented to new recoverable mission.

(4) SS B be increased to provide for dual burn and modification of existing engine.

(5) SS C be increased to expedite power supply development.

(6) SS D be reoriented to provide required stabilization and control.

(7) SS E be re-directed to cancel all effort on 6-inch camera, in flight film processing facsimile readout. — Use remaining funds to develope C camera for new applications and initiate work on electrostatic storage for 36-inch camera readout.

(8) SS F. Stop construction of packages for present program and redesign for new combined application.

(9) SS G. Discontinue all work and transfer costs to MIDAS Program.

(10) SS K. Discontinue all effort on ground-space system that was directed toward handling data from SS E--and precision tracking--reorient funds to providing MINIT readout at existing stations and the use of Azusa (existing stations, if possible) for precision tracking.

(11) SS L. Initiate new program for recoverable package to accomplish stated objectives.

(12) GSFC. Cancel all possible effort and transfer effort from TIROS Program.

(13) NARC. Discontinue present effort and start study on how to handle data from recovery system.

(14) MTT. Reorient effort to new program with reduced dispersion.

(15) Booster. Order three additional Atlas boosters to cover all shots scheduled for FY 1960.

(16) STL. Add small allowance for participation in new program.

Cost Summary - Atlas Program - FY 1959

Item	15 Sept. Rev. Plan	Net Change	Proposed Program
Program Management	1.0	+ .2	1.2
Systems Eng.	12.7	+2.5	15.2
SSA (airframe)	.9	+2.5	3.4
SSB (propulsion)	.9	+2.5	3.4
SSC (auxiliary power)	.9	+2.1	3.0
SSD (guidance and control)	4.2	+ .8	5.0
SSE (visual reconnaissance)	11.7	—	11.7
SSF (Ferret reconnaissance)	6.7	—	6.7
SSG (infra-red reconnaissance)	.4	- .4	—
SSH (ground space communication)	9.6	—	9.6
SSL (recovery capsule)	—	+2.0	2.0
GSE (ground support equipment)	2.9	-1.9	1.0
CRC (Cambridge Research Ctr)	—	—	—
RADC (Rome Air Development Center data processing)	9.0	-4.0	5.0
MIT	1.9	+ .1	2.0
Boosters	10.8	+7.5	18.3
STL (Space Technology Lab)	—	+ .2	.2
Support	—	—	—
Misc	—	+ .5	.5
TOTAL	73.6	14.6	88.2

FY 1960 PROGRAM

	15 Sep Data Plan	Proposed Program
Thor Program	30.0	.0
Facilities	16.5	5.0
Atlas Program	250.5	155.0
	297.0	160.0

The following assumptions were made in arriving at the above figures.

Thor Program

(1) All effort on the Thor Program will be discontinued for this year.

(2) That the 7.2 M asked for SSL in MEBM 58-492 was in error.

(3) That costs listed represented the cost of four complete vehicles.

Facilities Program - FY 1960

(1) Additional launcher at Cooke AFB will not be required.

(2) Additional consideration for development control and intelligence centers will not be required.

(3) Advanced facilities planning costs will be assumed by the USAF.

(4) That additional industrial facilities will not be required due to reduction in overall scope of program.

(5) That an amount of approximately $5 M will be required for construction or manufacture of tracking facilities.
modification

TOP SECRET

Cost Summary - Facilities

Item	15 Sept Rev. Plan	Proposed Program
Launcher - Cocoa AFB	6.0	0.0
Development & Analysis costs	4.12	0.0
Construction planning	.65	0.0
Industrial Facilities	5.70	0.0
Tracking	.0	5.0
	16.5	5.0

Atlas Program - FY 1960

(1) Program management and Systems engineering costs be reduced in proportion to program remaining at Lockheed.

(2) SSA unchanged

(3) SSB Increased to provide for dual burn modification

(4) SSC unchanged

(5) SSD Increased for improved stabilization

(6) SSE Reduced due to simpler system payloads

(7) SSF Reduced due to combined payloads.

(8) SSH Not required for visual readout

(9) SSL added for recoverable sections

(10) GSE reduced as only one launcher used and equipment transferred from Thor program

(11) GSC Cancel completely

(12) RADC direct toward long range plans and equipment for recovery only

(13) MIT Increase for improved stabilization and improve dispersion on recovery package

(14) Boosters Purchase all equipment for CTV 60 program

(15) Support - Reduce in proportion to Thor program

(16) Misc. - What is left 12

Cost Summary - Atlas Program - FY 1960

Item	15 Sept Data Item	Net Change	Proposed Program
Program Management	3.9	- 1.3	2.6
Systems Engr.	46.1	-16.1	30.0
SSA	5.1	—	5.1
SSB	10.1	+ .9	11.0
SSC	6.1	—	6.1
SSD	6.8	+ 1.2	8.0
SSE	36.1	-11.1	25.0
SSF	17.9	- 2.9	15.0
SSH	35.4	-25.4	10.0
SSL	7.2	—	7.2
GSE	16.4	-12.9	3.5
GAC	1.0	- 1.0	0.0
RADC	19.0	-14.0	5.0
MIT	2.1	+ 1.0	3.1
BOOSTERS	23.4	-10.9	12.5
STL	1.0	—	1.0
SUPPORT	12.0	- 6.0	6.0
MISC	.9	+ 3.0	3.9
	250.5	-95.5	155.0

RECOMMENDATIONS

1. It is recommended that the re-oriented Thor program as outlined within the report be established. This requires reducing the number of Thor launchings from 19 to 13 as chargeable to the WS-119L program. Approximately $30 millions dollars in FY 1960 is saved in this action. Additional savings in FY 1959 are made as described within the report.

2. It is recommended that the revised Atlas/Sentry program as outlined within the report be established. It has been tentatively established that this program can be carried out within the FY 1960 budget limit of $160 million. The original program estimated cost for FY 1960 was $297 millions.

3. It is recommended that any operational requirements utilizing the Thor/Sentry or Atlas/Sentry vehicle or associated ground base equipment be funded by the Agency having the requirement. These items as discussed within the report will afford considerable savings to the program.

4. It is recommended that discussions be initiated immediately, providing the other actions recommended are accepted, with the Air Force and contractors to "price-out" the revised program as recommended herein.

SIGNED

E. G. Cesaro, Chairman

SIGNED

C. R. Irvine

SIGNED

L. L. Lind

SIGNED

R. C. Truax

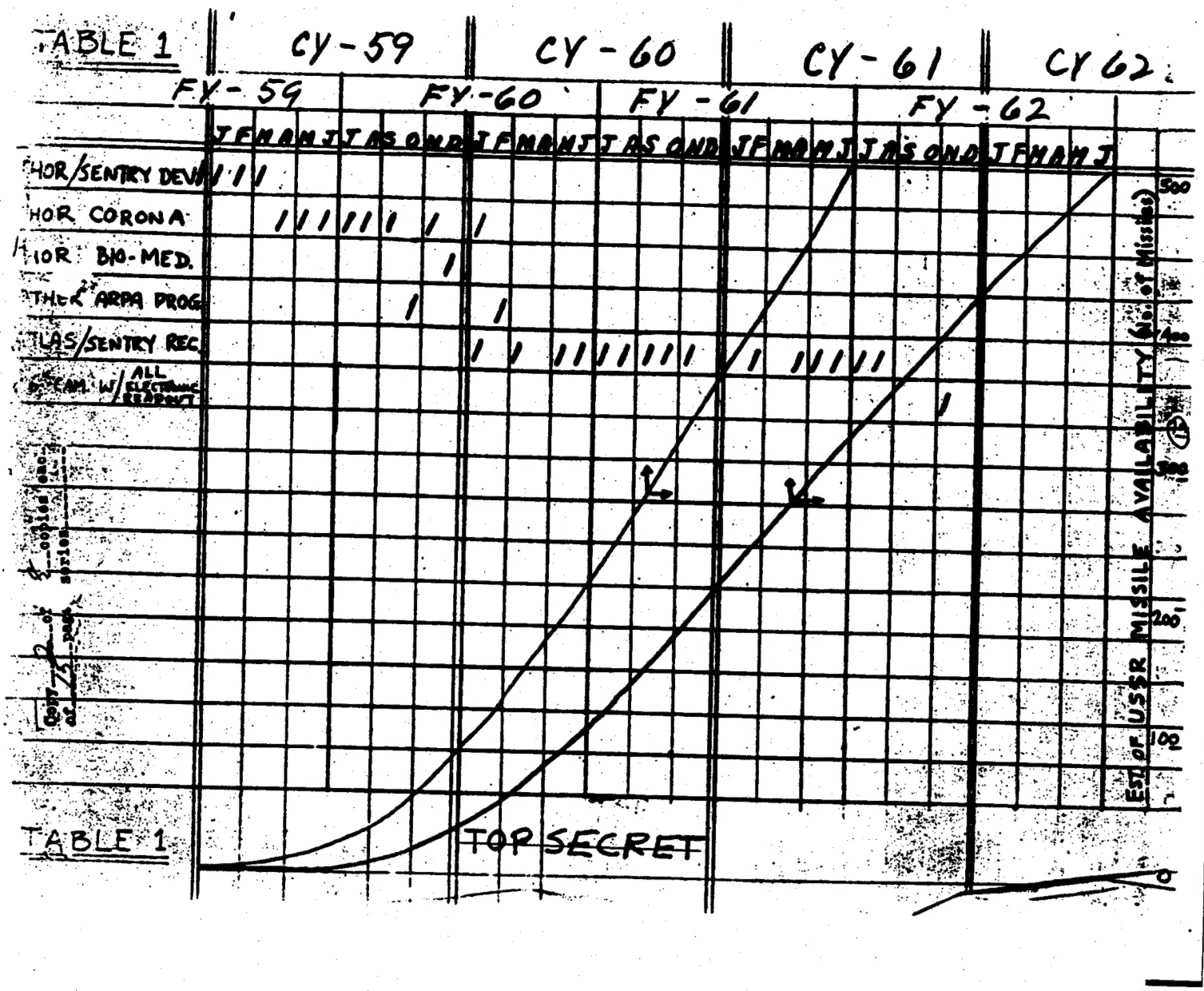
TABLE 1
CY-59
CY-60
CY-61
CY 62
FY-59
FY-60
FY-61
FY-62
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
HOR/SENTRY DEV
HOR CORONA
IOR BIO-MED.
THER ARPA PROG
LAS/SENTRY REC
CAM. W/ ALL ELECTRONIC READOUT
ESTIMATED USSR MISSILE AVAILABILITY (No. of Missiles)
500
400
300
200
100
TOP SECRET
TABLE 1